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PATENT ABSTRACTS OF JAPAN

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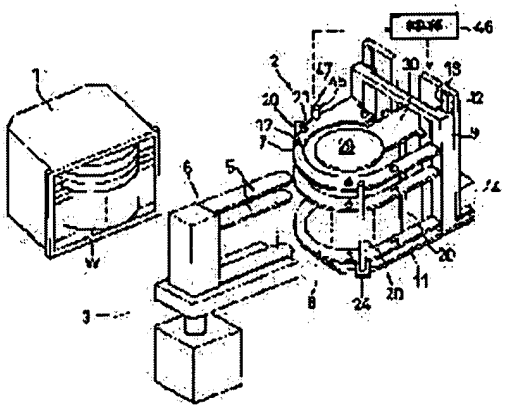
(54) WAFER ALLIGNMENT AND APPARATUS THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To enable collective adjustment of center and orientation with respect to a plurality of wafers to be treated.

SOLUTION: The apparatus includes a support part 7 capable of elevating for lifting up peripheral edges of a plurality of wafers W to be treated supported in horizontal condition at multiple stages and transferred from a horizontal direction by means of a transfer arm 6, support columns 20 disposed around the support part 7 movably in nearly its radial direction for collectively centering the wafers W as contacted with the peripheral edges of the wafers W at least from three directions, rotary tables 29 provided in multiple stages as associated with the support part 7 therein for carrying the wafers W thereon as the support part moves down, a detector 45 for detecting a positioning mark 4 provided to the peripheral edge of each wafers W, and a controller 46 for controlling rotations in the rotary tables 29 in such a manner that a detection signal issued from the detector 45 causes the marks to be aligned along one direction.



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CLAIMS

[Claim(s)]
[Claim 1] The process which dips up the periphery section of two or more processed substrates which were supported by multistage in the level condition by the conveyance arm, and were conveyed from the horizontal direction with a multistage supporter, and supports it, The process which a stanchion is contacted in the periphery section of the processed substrate supported by the above-mentioned supporter multistage from at least 3 directions, bundles up, and performs a centering, The substrate alignment approach characterized by having the process aligned so that the above-mentioned processed substrate may be laid on the multistage rotary table which the above-mentioned supporter is dropped and corresponds with a supporter, the mark for positioning which is made to rotate a processed substrate and it has in the periphery section may be detected and the mark may be equal to an one direction.
[Claim 2] The substrate alignment approach according to claim 1 characterized by detecting the mark by the above-mentioned detecting element, rotating [rotate a processed substrate by the drive of the above-mentioned rotary table, and] hard flow at a low speed after stopping rotation so that the above mark may exceed a detecting element.
[Claim 3] The supporter which dips up the periphery section of two or more processed substrates which were supported by multistage in the level condition by the conveyance arm, and were conveyed from the horizontal direction, and is supported to multistage and which can be gone up and down, The stanchion which is arranged around the above-mentioned supporter, is mostly prepared in radial movable, contacts and bundles up from at least 3 directions in the periphery section of the above-mentioned processed substrate, and performs a centering, The rotary table which is arranged multistage at the inside corresponding to the above-mentioned supporter, and lays a processed substrate by descent of a supporter, Substrate array apparatus characterized by having the detecting element which detects the mark for positioning which it has in the periphery section of a processed substrate, and the control section which controls the rotation of a rotary table so that the above mark is equal to an one direction with the detecting signal from this detecting element.
[Claim 4] Substrate array apparatus according to claim 3 characterized by preparing the support pin which has the taper section which performs a preliminary centering to it in contact with the periphery section when dipping up a processed substrate in the above-mentioned supporter, and the step which supports the periphery section of the processed substrate by which the centering was carried out possible [horizontal migration] in the small range.
[Claim 5] Substrate array apparatus according to claim 3 characterized by preparing the above-mentioned rotary table in the support frame of the hollow which held that base side rotation section in the interior, and establishing the exhaust port for connecting to this support frame an exhaust air means to exhaust the interior to negative pressure.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the substrate alignment approach and its equipment.
[0002]
[Description of the Prior Art] Since it faces processing or inspecting a processed substrate (only henceforth a wafer), for example, a semi-conductor wafer, generally and there is directivity of a crystal in a wafer, it must align about direction of a wafer. For this reason, the orientation flat (it is also called a cage hula) or the notch is prepared in the periphery section of a wafer as a mark for positioning. In addition, since there are few parts which the direction of a notch has a small notching area of a wafer, and become useless than a cage hula, there is an inclination that to the diameter wafer of macrostomia adopted. [many]
[0003] In the processor of a batch type which processes several wafers collectively and -- for example, -- many -- In the condition [having held two or more wafers, for example, 25 sheets, in the perpendicular condition in the cassette (it also being called a carrier) which is a container for conveyance made from plastics in the case of a 8 inch wafer] A roller is contacted to the wafer in a cassette from a lower part, rotation is given, and the substrate array apparatus of the batch type it was made to align a cage hula in an one direction is proposed. Moreover, in the processor of single wafer processing which processes one wafer at a time, it carries one wafer at a time on a rotary table, and the device which was made to perform the sense of a wafer and main alignment is proposed.
[0004]
[Problem(s) to be Solved by the Invention] However, applying is becoming difficult in order for the stress by self-weight to cut in many to a wafer by the existing batch type substrate array apparatus with diameter[of macrostomia]-izing for which the diameter of a wafer exceeds 12 inches (300mm). Moreover, although the cassette of closed mold is examined in order to suppress particle contamination of a wafer, a wafer cannot be aligned within a cassette in this case.
[0005] In such a case, although it must align by taking out a wafer from the inside of a cassette, since it puts five sheets in block at a time and a wafer is transferred to two or more sheets, for example, the wafer boat which is a fixture for heat treatment, in the thermal treatment equipment which heat-treats, for example to a batch type, a throughput will fall by the device performed by putting one wafer at a time on a rotary table like previous statement.
[0006] Then, this invention is made that the technical problem mentioned above should be solved. The purpose of this invention is to offer the substrate alignment approach that it can bundle up to two or more processed substrates, and alignment of a core and the sense can be performed, and its equipment.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned purpose the substrate alignment approach of this invention The process which dips up the periphery section of two or more processed substrates which were supported by multistage in the level condition by the conveyance arm, and were conveyed from the horizontal direction with a multistage supporter, and supports it, The process which a stanchion is contacted in the periphery section of the processed substrate supported by the above-mentioned supporter multistage from at least 3 directions, bundles up, and performs a centering, The above-mentioned processed substrate is laid on the multistage rotary table which the above-mentioned supporter is dropped and corresponds with a supporter, the mark for positioning which is made to rotate a processed substrate and it has in the periphery section is detected, and it is characterized by having the process aligned so that the mark may be equal to an one direction.
[0008] It becomes possible to bundle up to two or more processed substrates, and to perform alignment of a core and the sense by this. In the above-mentioned substrate alignment approach, when detecting the mark by the above-mentioned detecting element aims at improvement in detection precision, rotating [rotate a processed substrate by the drive of the above-mentioned rotary table, and] hard flow at a low speed after stopping rotation so that the above mark may exceed a detecting element, it is desirable.
[0009] Moreover, the supporter which dips up the periphery section of two or more processed substrates which the substrate array apparatus of this invention was supported by multistage in the level condition by the

conveyance arm, and were conveyed from the horizontal direction, and is supported to multistage and which can be gone up and down, The stanchion which is arranged around the above-mentioned supporter, is mostly prepared in radial movable, contacts and bundles up from at least 3 directions in the periphery section of the above-mentioned processed substrate, and performs a centering, The rotary table which is arranged multistage at the inside corresponding to the above-mentioned supporter, and lays a processed substrate by descent of a supporter, It is characterized by having the detecting element which detects the mark for positioning which it has in the periphery section of a processed substrate, and the control section which controls the rotation of a rotary table so that the above mark is equal to an one direction with the detecting signal from this detecting element.
[0010] It becomes possible for this to bundle up to two or more processed substrates with an easy configuration, and to perform alignment of a core and the sense, and miniaturization of equipment and improvement in a throughput can be aimed at. It is desirable, when dipping up a processed substrate to the above-mentioned supporter and performing a centering in the above-mentioned substrate array apparatus in two steps so that it may not give stress that the support pin which has the taper section which performs a preliminary centering in contact with the periphery section, and the step which supports the periphery section of the processed substrate by which the centering was carried out possible [horizontal migration] in the small range is prepared to a processed substrate. Moreover, it is desirable when it prevents particle contamination that the above-mentioned rotary table is prepared in the support frame of the hollow which held that base side rotation section in the interior, and the exhaust port for connecting to this support frame an exhaust air means to exhaust the interior to negative pressure is established.
[0011]
[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained in full detail based on an accompanying drawing. The outline perspective view showing a part of transfer station containing the substrate array apparatus which drawing 1 requires for the gestalt of operation of this invention, the top view in which drawing 2 shows this substrate array apparatus, and drawing 3 are the side elevations showing this substrate array apparatus.
[0012] For example, the transfer station for transferring the semi-conductor wafer W which is one of the batch type processors and which is a processed substrate in the case of a vertical mold thermal treatment equipment is prepared. The cassette 1 which is the container for conveyance made from plastics which held two or more wafers, for example, 13 sheets, W with a diameter [of macrostomia] of 300mm, for example, diameter, in this transfer station multistage, The substrate array apparatus 2 which performs a centering (main alignment: centering) and notch doubling (alignment of a hoop direction) to multistage on the same axle (on the same center line) in support of two or more wafers, for example, five sheets, W, The transfer device 3 in which ****** of Wafer W is performed between between these cassettes 1 and the substrate array apparatus 2 or this substrate array apparatus 2, and the wafer boat of the perpendicular standing-up condition which is the fixture for heat treatment which is not illustrated is established.
[0013] The notch 4 which is the notch of a small hemicycle is formed in the periphery section of the above-mentioned wafer W as a mark for positioning which shows crystal orientation (refer to drawing 2). The above-mentioned cassette 1 is laid in the cassette stage in a transfer station. As the above-mentioned cassette 1, in order to suppress particle contamination of Wafer W, it is desirable that it is the closed mold equipped with the removable lid which is not illustrated in the front disconnection section. The lid of a cassette 1 is opened and closed by the breaker style which is not illustrated.
[0014] The above-mentioned transfer device 3 is equipped with the conveyance arm 6 which has the sheet metal-like fork 5 in multistage so that two or more wafers, for example, five sheets, W can be transferred collectively, and this conveyance arm 6 is constituted horizontally possible [an attitude, level rotation, and rise and fall]. Moreover, as for the fork 5 of the above-mentioned conveyance arm 6, it is desirable that array spacing (vertical spacing) is constituted by adjustable.
[0015] The above-mentioned substrate array equipment 2 is equipped with the supporter 7 which dips up the periphery section of two or more wafers W conveyed from the horizontal direction by the above-mentioned conveyance arm 6, and is supported to multistage and which can be gone up and down as shown also in drawing 2 thru/or drawing 3 . This supporter 7 is constituted by the level support plate 8 formed in the shape of a flat surface of about U characters. The support plate 8 is formed in the shape of a cantilever by being arranged multistage, for example, five steps, and attaching the end face section in the vertical direction common to the rise-and-fall frame 9 suitably, at the same spacing as spacing (wafer receipt slot pitch), for example, wafer receipt spacing in the above-mentioned cassette 1. In order to hold spacing of these support plates 8 with a sufficient precision, it is desirable to interpose a spacer 10 between base the ****** support plate 8 sides, and to fix a support plate 8 to the rise-and-fall frame 9 through these spacers 10.
[0016] The above-mentioned rise-and-fall frame 9 is supported possible [rise and fall] through the guide 13, for example, a linear guide, by the fixed frame 12 set up on the base plate 11. Moreover, the rise-and-fall mechanical component 14 which carries out rise-and-fall actuation of the above-mentioned rise-and-fall frame 9 and which has a ball screw, for example is attached in the fixed frame 12. It may be made to perform detection of the rise-

and-fall height level of the rise-and-fall frame 9 by forming sensors, such as an encoder, in the rise-and-fall mechanical component 14, or it forms the dog 15 which is the detected body in the rise-and-fall frame 9 like the example of illustration, and it may be made to perform it by forming the sensor 16 which detects the dog 15 to a fixed frame 12.

[0017] The support plate 8 which constitutes the above-mentioned supporter 7 may be constituted so that the inferior surface of tongue of Wafer W may be directly supported by field contact on the top face, but in order to attain mitigation of the frictional resistance at the time of a wafer centering, easy-ization of the transfer by fork 5, etc. The thing which support the periphery section of each wafer W in the condition of having floated from the top face of a support plate 8, on the top face of a support plate 8 and for which two or more four support pins 17 are suitably formed in the hoop direction at spacing, for example is desirable. Moreover, this support pin 17 is desirable, when dipping up Wafer W and performing a centering in two steps so that having the taper section 18 which performs a preliminary centering in contact with that periphery section, and the step 19 which supports the periphery section of the wafer W by which the centering was carried out possible [horizontal migration] in the small range may mention later, and stress may not be given to a wafer.

[0018] The above-mentioned support pin 17 is simply obtained by forming the cone section or the truncated cone section of a minor diameter in the upper limit of the cylinder section of for example, predetermined height rather than this. Between the support plates 8 located in right above [of the support pin 17 / the upper limit and right above / of it], the predetermined clearance for carrying out carrying-in taking out of the wafer W from a horizontal direction needs to be formed. As an ingredient of the above-mentioned support pin 17, although you may be a quartz, for example, frictional resistance is small and little resin, for example, PEEK resin, is suitable also for the particle contamination to a wafer.

[0019] The periphery section of the wafer W of each stage is contacted from at least 3 directions, the stanchion 20 which bundles up the centering of Wafer W and performs it is arranged, and Wafer W is mostly formed for these stanchions 20 in the perimeter of the above-mentioned supporter 7 movable radial. In the example of illustration, three stanchions 20 are mostly arranged at equal intervals in the hoop direction so that it may be located in the perimeter of Wafer W, and one of them is arranged inside the support plate 8 on the layout. Moreover, it is desirable that the notch 21 for avoiding interference with other two stanchions 20 is formed in the periphery section of a support plate 8. As an ingredient of a stanchion 20, although you may be a quartz, for example, an alumina is suitable. Moreover, as a configuration of a stanchion 20, the shape of a cylinder is desirable.

[0020] On the above-mentioned base plate 11, the air cylinder 22 of Wafer W which carries out attitude migration is mostly arranged by radial in support of the lower limit section of each strut 20 in the above-mentioned stanchion 20 radial as a driving means of Wafer W which carries out migration actuation. The air cylinder 22 of the example of illustration equips the upper part with the agonist 24 which carries out attitude migration horizontally through the linear guide 23, and the above-mentioned stanchion 20 is set up by this agonist 24. On the above-mentioned base plate 11, in order to regulate the migration stroke of the above-mentioned stanchion 20, as shown also in drawing 7 , you make it located in the 1 side of an air cylinder 22, and the stopper shaft 25 parallel to this is established through the stopper base 26.

[0021] The arm 27 fixed to the agonist 24 of the above-mentioned air cylinder 22 is engaging with the above-mentioned stopper shaft 25 possible [sliding], and it is constituted so that the migration stroke end (an advance end and retreat end) of a stanchion 20 may be regulated by this. Moreover, the screw section 28 screwed in the stopper base 26 is formed in the base side of the above-mentioned stopper shaft 25, and the location of the migration stroke end of a stanchion 20 can be adjusted now by rotating the stopper shaft 25. In order for a stanchion 20 to press the periphery section of Wafer W beyond the need and to make it not give stress, rotation of the above-mentioned stopper shaft 25 adjusts the location of the advance end.

[0022] The disc-like rotary table 29 which lays Wafer W by descent of a supporter 7 inside the above-mentioned supporter 7 is arranged multistage, for example, five steps, corresponding to the support plate 8 of a supporter 7. Each rotary table 29 is formed in the tip side upper part of the level support frame 30, and the base side of each support frame 30 is being fixed to the above-mentioned fixed frame 12 in common. The above-mentioned rotary table 29 and the support frame 30 are formed in the magnitude which does not interfere in rise-and-fall migration of the above-mentioned support plate 8.

[0023] Although Wafer W may be directly supported in the top face of the above-mentioned rotary table 29, it is more desirable than viewpoints, such as antisticking of a contaminant, that the plurality 31 for floating and supporting Wafer W from the top face of a rotary table 29, for example, three **-like supporting material, is formed. As an ingredient of this **-like supporting material 31, cull RETTSU (trade name) is desirable on for example, what has buffer nature and frictional resistance, fluorine system rubber with little particle contamination to a wafer also in it, and a concrete target.

[0024] As shown also in drawing 4 , in order to hold the base side rotation section 32 of a rotary table 29, as for the above-mentioned support frame 30, it is desirable to be formed in box-like [from which the interior became hollow]. In this case, the support frame 30 is formed in box-like [with which the upper part was opened wide], and it is suitable on a maintenance that the frame cover 33 is attached in that upper part removable by the screw

stop etc. A pivot 34 is set up, it is attached in the tip side in the above-mentioned support frame 30 pivotable in the condition that the follower pulley 36 penetrates the above-mentioned frame cover 33 through bearing 35, for example, cross bearing, to this pivot 34, and the rotary table 29 is attached in the upper limit section of this follower pulley 36 removable by the screw stop etc. The above-mentioned follower pulley 36 grade constitutes the base side rotation section 32 of a rotary table 29.

[0025] the end face side in the above-mentioned support frame 30 -- an electric motor -- the driving pulley 38 preferably driven by the pulse motor 37 arranges -- having -- this driving pulley 38 and the above-mentioned follower pulley 36 -- a belt -- a timing belt 39 is rolled almost preferably. As the above-mentioned motor 38 is shown also in drawing 5 , it is attached in the motor base 40 and this motor base 40 is attached in the end face side inferior surface of tongue of the above-mentioned support frame 30 with the screw 41.

[0026] While the slot 42 is formed so that it can justify on the occasion of anchoring with a screw 41, the hook 43 for pulling the motor base 40 is formed in the above-mentioned motor base 40 in one in order to give a desired tension to the above-mentioned timing belt 39. By hooking and pulling a pull gage on this hook 43, a timing belt 39 can be stretched by proper tension. In addition, in order to avoid interference of ****** motor 37 comrades, as for a motor 37, it is desirable to be arranged by turns at right and left.

[0027] Moreover, it is desirable when it prevents particle contamination that the exhaust port 44 for connecting the suction tube which leads, the exhaust air means, for example, the exhaust air system, which exhausts the interior to negative pressure, and which is not illustrated, as shown also in drawing 6 is established in the end face side of the above-mentioned support frame 30. Thereby, the contaminant generated from the base side rotation section 32 and the timing-belt 39 grade of a rotary table 29 can prevent dispersing out of the support frame 30, and can prevent particle contamination of Wafer W.

[0028] On the other hand, the detecting element 45 which detects the notch 4 which it has in the periphery section of Wafer W is formed in the side of the above-mentioned supporter 7, and it is constituted so that the above-mentioned notch 4 is equal to an one direction based on the detecting signal from this detecting element 45 and the rotation of a rotary table 29 may be controlled by the control section 46. The above-mentioned detecting element 45 is formed in the sensor tower 47 set up on the base plate 11 corresponding to the wafer W on each rotary table 29.

[0029] The location of a notch 4 can be detected now by the above-mentioned detecting element's 45 consisting of a photosensor which has the floodlighting section 48 which counters on both sides of the periphery section of each wafer W, and a light sensing portion 49 as shown also in drawing 8 , and being in the condition of passing through a notch 4 from the condition that the optical axis which becomes a light sensing portion 49 from the other side, for example, an infrared light line, was intercepted in the periphery section of Wafer W from the floodlighting section 48. In order to prevent incorrect detection, it is desirable that the gobo 50 is arranged between ****** photosensors. Moreover, it is desirable that the notch 51 is formed in the periphery section of the above-mentioned support plate 8 in order to avoid interference with the sensor tower 47 which has a detecting element 45.

[0030] In the substrate alignment approach of aligning the notch 4 of the above-mentioned wafer W in an one direction, when being constituted so that the above-mentioned detecting element 45 may detect a notch 4 aims at improvement in detection precision, rotating [make an one direction rotate Wafer W by the drive of the above-mentioned rotary table 29, and] hard flow at a low speed after [when the above-mentioned notch 4 exceeds a detecting element 45 (it overruns)] making it like and stopping rotation, it is desirable. Moreover, if the above-mentioned detecting element 45 detects the location of a notch 4, when making it only desired angle of rotation rotate Wafer W from the location, a notch 4 can be aligned towards desired.

[0031] Although the substrate array apparatus 2 which consists of the above configuration is installed on the installation base 52, in order to attain easy-ization of positioning in that case, it is desirable to adopt the kinematic coupling 53. This kinematic coupling 53 consists of block 55 which has the slot 54 of the shape of cross-section reverse of V characters arranged in the pars basilaris ossis occipitalis of the base plate 11 of the substrate array apparatus 2, and an axis 56 which has the point of the shape of the spherical surface which engages with the slot 54 of this block 55, as shown in drawing 3 thru/or drawing 9 .

[0032] The above-mentioned block 55 is attached in the inferior surface of tongue of a base plate 11 at the predetermined spacing at three radials. The above-mentioned axis 56 makes the installation base 52 correspond with the above-mentioned block 55, and is set up three. The axis 56 is screwed in the installation base 52, and height adjustment is possible. By laying the substrate array apparatus 2 so that the slot 54 of block 55 may be engaged on these axes 56, the substrate array apparatus 2 can be easily positioned to a position. What is necessary is just to fix the base plate 11 of the substrate array apparatus 2 to the installation base 52 with the securing bolt which is not illustrated after positioning. Thus, since positioning can be done easily, also when installing the substrate array apparatus 2 in narrow space, installation can be done correctly and easily and a maintenance is also easy installation.

[0033] As for one block 55, it is desirable among three above-mentioned blocks 55 to make it in agreement in the conveyance direction X of the wafer W by the conveyance arm 6 to the substrate array apparatus 2. This

becomes possible to perform parallel adjustment to the wafer W conveyed easily only by performing height adjustment of right and left by the axis 56 corresponding to other two blocks 55.
[0034] Next, the operation of the substrate array apparatus 2 and the substrate alignment approach of consisting of the above-mentioned configuration are described. First, the fork 5 of the conveyance arm 6 of the transfer device 3 is made to advance into a cassette 1, two or more wafers, for example, five sheets, W are put in block in the state of multistage, and are dipped up, and it takes out out of a cassette 1. Next, Wafer W is carried in from a horizontal direction in the substrate array apparatus 2 by changing and advancing the sense of the above-mentioned fork 5 in the direction of the substrate array apparatus 2. the support plate 8 of the supporter [in / at this time / the substrate array apparatus 2] 7 -- elevating length -- it is mostly set as the mid-position, and Wafer W and fork 5 advance horizontally between the support plate 8 upper part of the maximum upper case, and the ****** support plate 8, without contacting the support pin 17 and rotary table 29 on a support plate 8.
[0035] If Wafer W is conveyed in the substrate array apparatus 2 by the above-mentioned conveyance arm, the rise-and-fall mechanical component 14 will start, and a support plate 8 will carry out updrift to a rise end through the rise-and-fall frame 9. Wafer W is dipped up out of on fork 5 by the updrift of these support plates 8. Since the support pin 17 prepared on the support plate 8 is formed in the configuration which has the taper section 18 and a step 19 at this time, while the periphery section of Wafer W is guided by the taper section 18 of the support pin 17 to the inner direction and a rough and preliminary centering is performed, finally it is supported by the step 19. Fork 5 retreats from the substrate array apparatus 2 after the pile raising termination described a top.
[0036] Next, when three stanchions 20 for centerings which are standing by in the retreat location move forward to the method of the inside of radial mostly by the drive of an air cylinder 22 and these stanchions 20 contact and press in the periphery section of the wafer W of each stage at coincidence, it is carried out by the centering of two or more wafers W bundling up. At this time, since the periphery section of Wafer W is supported possible [horizontal migration] in the small range on the step 19 of the support pin 17, a centering is performed easily smoothly. By regulating the advance end of the above-mentioned stanchion 20 with the stopper shaft 25, there is no possibility of the thrust beyond the need not acting on Wafer W, and giving stress to Wafer W.
[0037] moreover, as the 1st step, after the taper section 18 of the support pin 17 performs the rough and preliminary centering of the wafer W of each stage according to an individual, as the 2nd step Since it was made to perform the centering of Wafer W in two steps as it bundled up with the common stanchion 20 and the final centering (this centering) of the wafer W of a whole page was performed, it becomes possible to perform a centering smoothly, without giving stress to Wafer W. The core of Wafer W is in agreement with the center of rotation of a rotary table 29 with this centering. After termination of the above-mentioned centering, a stanchion 20 retreats to a retreat end and separates from the periphery section of a wafer.
[0038] Next, the support plate 8 of a supporter 7 carries out downward migration to a downward end, and the wafer W of each stage is received and passed on a rotary table 29 from on the support pin 17. In this way, if Wafer W is laid on a rotary table 29, a rotary table 29 will rotate to an one direction, for example, a clockwise rotation, by the drive of a motor 37, and Wafer W will be rotated. If it results in the detecting element 45 which the notch 4 of that periphery section becomes from a photosensor by rotation of this wafer W, the location of a notch 4 will be detected by this detecting element 45, and the rotation of a rotary table 29 will be controlled so that a notch 4 is equal to an one direction with a control section 46 based on this detecting signal.
[0039] In this case, it is desirable to control so that the above-mentioned detecting element 45 detects a notch 4, rotating [make an one direction (clockwise rotation) rotate Wafer W by the drive of the above-mentioned rotary table 29 and] hard flow (counterclockwise rotation) at a low speed, after [when the above-mentioned notch 4 exceeds a detecting element 45 (it overruns)] making it like and stopping rotation. This becomes possible to detect the location of a notch 4 correctly. Moreover, if the above-mentioned detecting element 45 detects the location of a notch 4, when making it only predetermined angle of rotation rotate Wafer W in this direction (counterclockwise rotation) from the location, a notch 4 can be turned and aligned in the predetermined direction.
[0040] In this way, if the centering of Wafer W and notch doubling are completed, a support plate 8 will dip up Wafer W out of on a rotary table 29 by [of elevating length] carrying out updrift to the mid-position mostly. Subsequently, the fork 5 of the conveyance arm 6 advances between Wafer W and a rotary table 29, and Wafer W is dipped up, and it takes out from the substrate array apparatus 2, and transfers to the wafer boat which is not illustrated.
[0041] Thus, according to the above-mentioned substrate array apparatus 2 thru/or the substrate alignment approach, it is effective in the cure against a throughput at the time of becoming possible to perform a centering and notch doubling to multistage on the same axle in support of two or more wafers W, and being able to aim at improvement in a throughput, for example, using the cassette of closed mold. Moreover, since the configuration is easy, miniaturization can be attained and an occupancy tooth space may also be narrow at a multilevel structure.
[0042] As mentioned above, although the gestalt of operation of this invention has been explained in full detail with the drawing, the various design changes in the range which is not limited to the gestalt of the above-mentioned implementation and does not deviate from the summary of this invention etc. are possible for this invention. For example, it is not necessary to be necessarily a notch or a cage hula for example, and you may be

a mark, a bar code, etc. as a mark formed in the periphery section of Wafer W. Moreover, it is not necessary to be necessarily belt driving for example, and you may make it link a thin motor with a rotary table directly as a driving means of a rotary table 29.

[0043] Moreover, you may make it use two or more substrate array apparatus 2, installing them. For example, a cassette 1 is arranged in two right and left, and is installed in a cassette stage, and you may make it install two substrate array apparatus 2 in right and left at the lower part, as shown in drawing 10 . According to this, while performing the centering of a wafer, and notch doubling by one substrate array apparatus, the transfer activity of the wafer in the substrate array apparatus of another side can be done, and further improvement in a throughput can be aimed at.

[0044]

[Effect of the Invention] In short, according to this invention, the following effectiveness can be done so above.

[0045] (1) According to the substrate alignment approach of this invention, dip up the periphery section of two or more processed substrates which were supported by multistage in the level condition by the conveyance arm, and were conveyed from the horizontal direction with a multistage supporter, and support it. After carrying out by contacting a stanchion in the periphery section of a processed substrate from at least 3 directions in the state of this support, and putting a centering in block, In order to make it align so that the mark for positioning which lays the above-mentioned processed substrate on the multistage rotary table which the above-mentioned supporter is dropped and corresponds with a supporter, and it has in the periphery section of a processed substrate may be equal to an one direction, It becomes possible to carry out easily in the tooth space to which alignment of a core and the sense was restricted collectively, without giving stress to two or more processed substrates, and improvement in a throughput can be aimed at.

[0046] (2) According to the substrate array apparatus of this invention Contact the periphery section of a processed substrate from at least 3 directions around the supporter which dips up the periphery section of two or more processed substrates which were supported by multistage in the level condition by the conveyance arm, and were conveyed from the horizontal direction, and is supported to multistage and which can be gone up and down, and the stanchion which bundles up a centering and performs it is arranged. Arrange in multistage the rotary table which lays a processed substrate by descent of a supporter inside the above-mentioned supporter, and a detecting element detects the mark for positioning which it has in the periphery section of a processed substrate. Since the rotation of a rotary table was controlled so that the above mark was equal to an one direction with a control section, it becomes possible to bundle up to two or more processed substrates with an easy configuration, and to perform alignment of a core and the sense, and miniaturization of equipment and improvement in a throughput can be aimed at.

[Translation done.]

* NOTICES *

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PRIOR ART

[Description of the Prior Art] Since it faces processing or inspecting a processed substrate (only henceforth a wafer), for example, a semi-conductor wafer, generally and there is directivity of a crystal in a wafer, it must align about direction of a wafer. For this reason, the orientation flat (it is also called a cage hula) or the notch is prepared in the periphery section of a wafer as a mark for positioning. In addition, since there are few parts which the direction of a notch has a small notching area of a wafer, and become useless than a cage hula, there is an inclination that to the diameter wafer of macrostomia adopted. [many]
[0003] and -- for example, -- many -- the processor of a batch type which processes several wafers collectively -- setting In the case of the 8 inch wafer, in the condition [having held two or more wafers, for example 25 sheets, in the perpendicular condition in the cassette (it also being called a carrier) which is a container for conveyance made from plastics], a roller is contacted to the wafer in a cassette from a lower part, rotation is given, and the substrate array apparatus of the batch type it was made to align a cage hula in an one direction is proposed. Moreover, in the processor of single wafer processing which processes one wafer at a time, it carries one wafer at a time on a rotary table, and the device which was made to perform the sense of a wafer and main alignment is proposed.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] In short, according to this invention, the following effectiveness can be done so above.
[0045] (1) It is a multistage supporter about the periphery section of two or more processed substrates which according to the substrate alignment approach of this invention were supported by multistage in the level condition by the conveyance arm, and were conveyed from the horizontal direction. After carrying out by dipping up and supporting, contacting a stanchion in the periphery section of a processed substrate from at least 3 directions in the state of this support, and putting a centering in block, In order to make it align so that the mark for positioning which lays the above-mentioned processed substrate on the multistage rotary table which the above-mentioned supporter is dropped and corresponds with a supporter, and it has in the periphery section of a processed substrate may be equal to an one direction, It becomes possible to carry out easily in the tooth space to which alignment of a core and the sense was restricted collectively, without giving stress to two or more processed substrates, and improvement in a throughput can be aimed at.
[0046] (2) According to the substrate array apparatus of this invention Contact the periphery section of a processed substrate from at least 3 directions around the supporter which dips up the periphery section of two or more processed substrates which were supported by multistage in the level condition by the conveyance arm, and were conveyed from the horizontal direction, and is supported to multistage and which can be gone up and down, and the stanchion which bundles up a centering and performs it is arranged. Since the rotation of a rotary table was controlled so that the rotary table which lays a processed substrate by descent of a supporter inside the above-mentioned supporter was arranged in multistage, a detecting element detected the mark for positioning which it has in the periphery section of a processed substrate and the above mark was equal to an one direction with a control section It becomes possible to bundle up to two or more processed substrates with an easy configuration, and to perform alignment of a core and the sense, and miniaturization of equipment and improvement in a throughput can be aimed at.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, applying is becoming difficult in order for the stress by self-weight to cut in many to a wafer by the existing batch type substrate array apparatus with diameter[of macrostomia]-izing for which the diameter of a wafer exceeds 12 inches (300mm). Moreover, although the cassette of closed mold is examined in order to suppress particle contamination of a wafer, a wafer cannot be aligned within a cassette in this case.
[0005] In such a case, although it must align by taking out a wafer from the inside of a cassette, since it puts five sheets in block at a time and a wafer is transferred to two or more sheets, for example, the wafer boat which is a fixture for heat treatment, in the thermal treatment equipment which heat-treats, for example to a batch type, a throughput will fall by the device performed by putting one wafer at a time on a rotary table like previous statement.
[0006] Then, this invention is made that the technical problem mentioned above should be solved. The purpose of this invention is to offer the substrate alignment approach that it can bundle up to two or more processed substrates, and alignment of a core and the sense can be performed, and its equipment.

[Translation done.]

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose the substrate alignment approach of this invention The process which dips up the periphery section of two or more processed substrates which were supported by multistage in the level condition by the conveyance arm, and were conveyed from the horizontal direction with a multistage supporter, and supports it, The process which a stanchion is contacted in the periphery section of the processed substrate supported by the above-mentioned supporter multistage from at least 3 directions, bundles up, and performs a centering, The above-mentioned processed substrate is laid on the multistage rotary table which the above-mentioned supporter is dropped and corresponds with a supporter, the mark for positioning which is made to rotate a processed substrate and it has in the periphery section is detected, and it is characterized by having the process aligned so that the mark may be equal to an one direction.
[0008] It becomes possible to bundle up to two or more processed substrates, and to perform alignment of a core and the sense by this. In the above-mentioned substrate alignment approach, when detecting the mark by the above-mentioned detecting element aims at improvement in detection precision, rotating [rotate a processed substrate by the drive of the above-mentioned rotary table, and] hard flow at a low speed after stopping rotation so that the above mark may exceed a detecting element, it is desirable.
[0009] Moreover, the supporter which dips up the periphery section of two or more processed substrates which the substrate array apparatus of this invention was supported by multistage in the level condition by the conveyance arm, and were conveyed from the horizontal direction, and is supported to multistage and which can be gone up and down, The stanchion which is arranged around the above-mentioned supporter, is mostly prepared in radial movable, contacts and bundles up from at least 3 directions in the periphery section of the above-mentioned processed substrate, and performs a centering, The rotary table which is arranged multistage at the inside corresponding to the above-mentioned supporter, and lays a processed substrate by descent of a supporter, It is characterized by having the detecting element which detects the mark for positioning which it has in the periphery section of a processed substrate, and the control section which controls the rotation of a rotary table so that the above mark is equal to an one direction with the detecting signal from this detecting element.
[0010] It becomes possible for this to bundle up to two or more processed substrates with an easy configuration, and to perform alignment of a core and the sense, and miniaturization of equipment and improvement in a throughput can be aimed at. It is desirable, when dipping up a processed substrate to the above-mentioned supporter and performing a centering in the above-mentioned substrate array apparatus in two steps so that it may not give stress that the support pin which has the taper section which performs a preliminary centering in contact with the periphery section, and the step which supports the periphery section of the processed substrate by which the centering was carried out possible [horizontal migration] in the small range is prepared to a processed substrate.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline perspective view showing a part of transfer station containing the substrate array apparatus concerning the gestalt of operation of this invention.
[Drawing 2] It is the top view showing this substrate array apparatus.
[Drawing 3] It is the side elevation showing this substrate array apparatus.
[Drawing 4] It is drawing of longitudinal section showing the support frame of a rotary table.
[Drawing 5] It is the bottom view showing the condition of having seen the motor part from the lower part.
[Drawing 6] It is the flat-surface sectional view showing the internal structure by the side of the base of a support frame.
[Drawing 7] the drive of a stanchion is shown -- it is a cross-section top view a part.
[Drawing 8] It is the side elevation showing a detecting element.
[Drawing 9] It is the explanatory view showing the arrangement configuration of kinematic coupling roughly.
[Drawing 10] It is the explanatory view showing roughly the arrangement configuration in the case of having arranged substrate array apparatus to 2 reams in a processor.
[Description of Notations]
W Semi-conductor wafer (processed substrate)
2 Substrate Array Apparatus
4 Notch (Mark)
6 Conveyance Arm
7 Supporter
17 Support Pin
18 Taper Section
19 Step
20 Stanchion
29 Rotary Table
30 Support Frame
44 Exhaust Port
45 Detecting Element
46 Control Section

[Translation done.]

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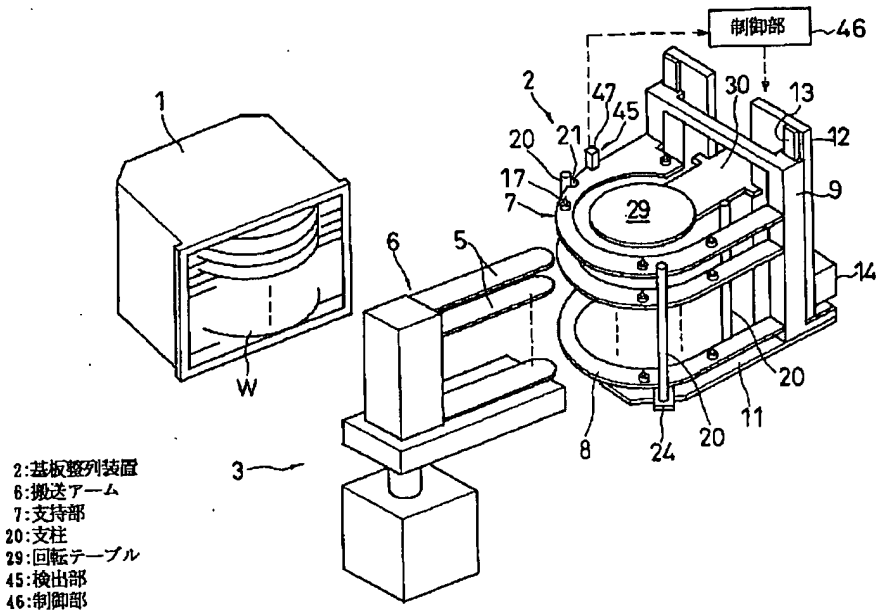
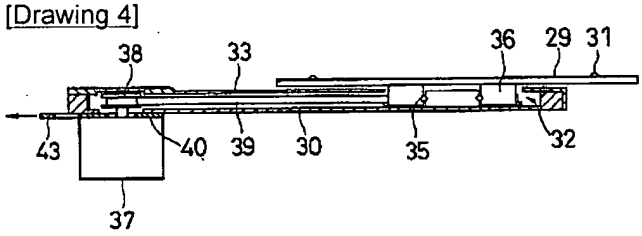
DRAWINGS

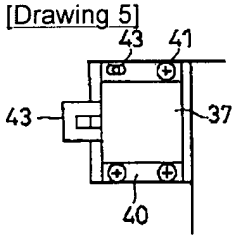
[Drawing 1]



[Drawing 4]

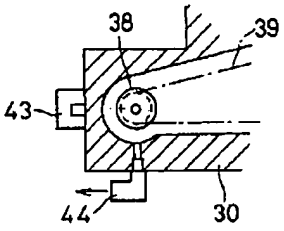


[Drawing 5]

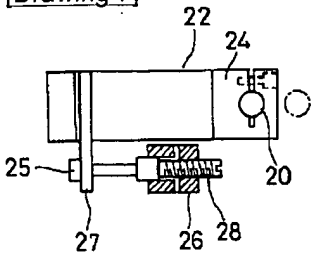


[Drawing 6]

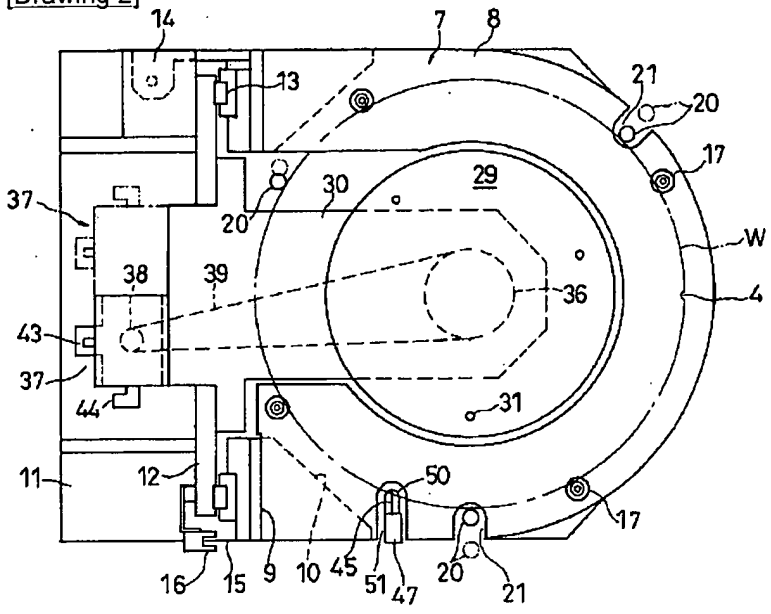
30:支持フレーム
44:排気口



[Drawing 7]

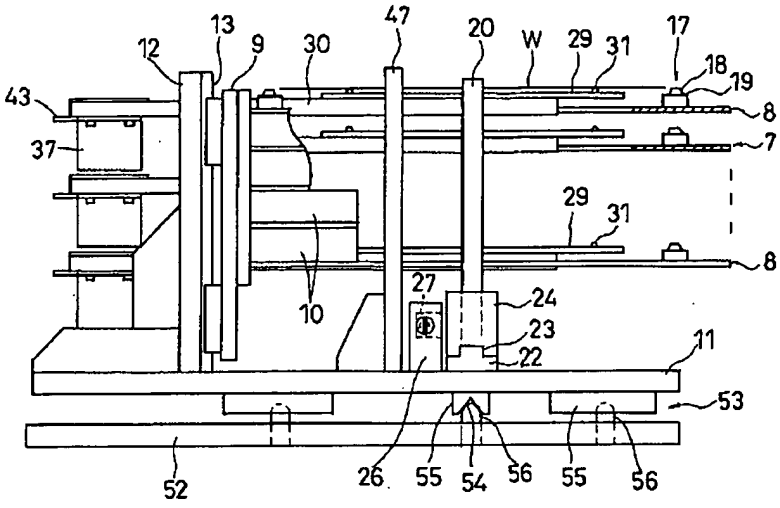


[Drawing 2]

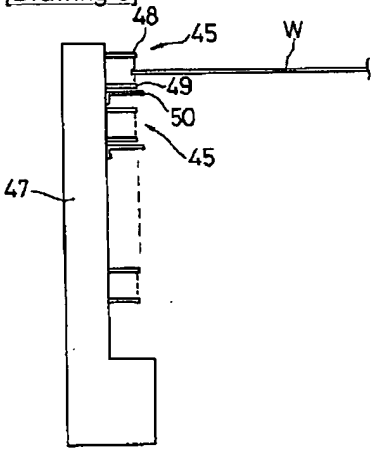


[Drawing 3]

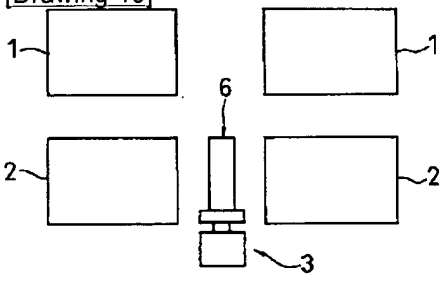
17:支持ピン
18:テーパー部
19:段部



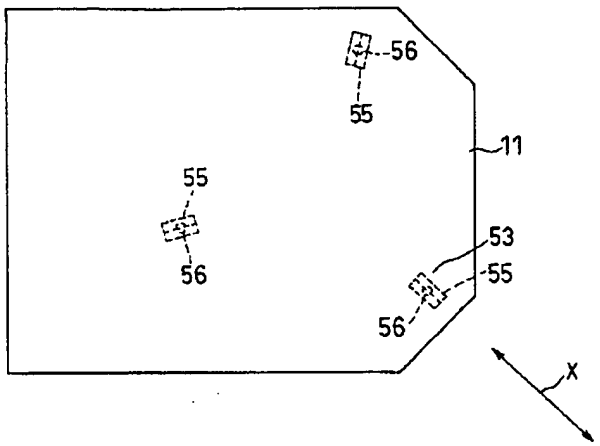
[Drawing 8]



[Drawing 10]



[Drawing 9]



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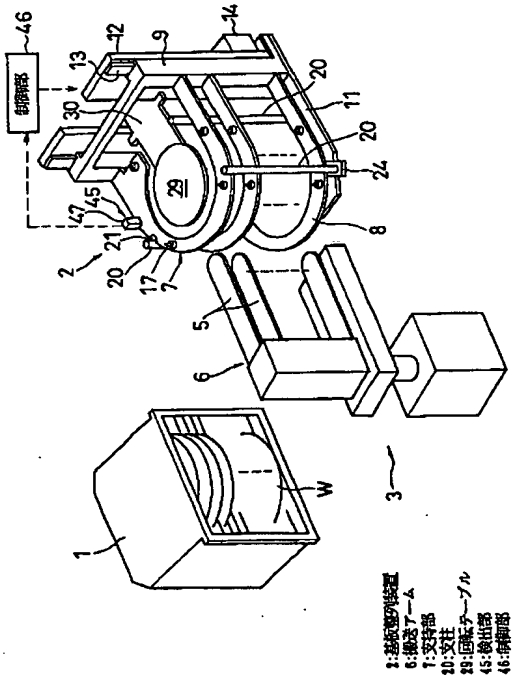
(54)【発明の名称】　基板整列方法およびその装置

(57)【要約】

【課題】　複数枚の被処理基板に対して一括して中心および向きの位置合せを行うことを可能とする。

【解決手段】　搬送アーム６により水平状態で多段に支持されて水平方向から搬送された複数枚の被処理基板Ｗの周縁部をすくい上げて多段に支持する昇降可能な支持部７と、上記支持部７の周囲に配置されてほぼ半径方向に移動可能に設けられ、上記被処理基板Ｗの周縁部に少なくとも３方向から接触して一括して心出しを行う支柱２０と、上記支持部７に対応してその内側に多段に配置され、支持部の下降により被処理基板Ｗを載置する回転テーブル２９と、被処理基板Ｗの周縁部に有する位置決め用の印４を検出する検出部４５と、この検出部４５からの検出信号により上記印４が一方向に揃うように回転テーブル２９の回転量を制御する制御部４６とを備えている。



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【特許請求の範囲】

【請求項１】　搬送アームにより水平状態で多段に支持されて水平方向から搬送された複数枚の被処理基板の周縁部を多段の支持部によりすくい上げて支持する工程と、上記支持部に多段に支持された被処理基板の周縁部に支柱を少なくとも３方向から接触させて一括して心出しを行う工程と、上記支持部を下降させて支持部と対応する多段の回転テーブル上に上記被処理基板を載置し、被処理基板を回転させてその周縁部に有する位置決め用の印を検出し、その印が一方向に揃うように整列させる工程とを備えたことを特徴とする基板整列方法。

【請求項２】　上記回転テーブルの駆動により被処理基板を回転させ、上記印が検出部を越えるように回転を停止させた後、逆方向に低速で回転させながら上記検出部により印を検出することを特徴とする請求項１記載の基板整列方法。

【請求項３】　搬送アームにより水平状態で多段に支持されて水平方向から搬送された複数枚の被処理基板の周縁部をすくい上げて多段に支持する昇降可能な支持部と、上記支持部の周囲に配置されてほぼ半径方向に移動可能に設けられ、上記被処理基板の周縁部に少なくとも３方向から接触して一括して心出しを行う支柱と、上記支持部に対応してその内側に多段に配置され、支持部の下降により被処理基板を載置する回転テーブルと、被処理基板の周縁部に有する位置決め用の印を検出する検出部と、この検出部からの検出信号により上記印が一方向に揃うように回転テーブルの回転量を制御する制御部とを備えたことを特徴とする基板整列装置。

【請求項４】　上記支持部には、被処理基板をすくい上げる時にその周縁部に接して予備的な心出しを行うテーパー部と、心出しされた被処理基板の周縁部を小範囲で水平移動可能に支持する段部とを有する支持ピンが設けられていることを特徴とする請求項３記載の基板整列装置。

【請求項５】　上記回転テーブルがその基部側回転部を内部に収容した中空の支持フレームに設けられており、この支持フレームには内部を負圧に排気する排気手段を接続するための排気口が設けられていることを特徴とする請求項３記載の基板整列装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、基板整列方法およびその装置に関する。

【０００２】

【従来の技術】一般に、被処理基板例えば半導体ウエハ（以下単にウエハともいう）を処理あるいは検査するに際して、ウエハには結晶の方向性があることから、ウエハの向きについて位置合せを行わなければならない。このため、ウエハの周縁部には、位置決め用の印として、オリエンテーションフラット（オリフラともいう）もしくはノッチが設けられている。なお、オリフラよりもノッチの方がウエハの切欠面積が小さく、無駄になる部分が少ないことから、大口径ウエハに多く採用される傾向がある。

2

【０００３】そして、例えば多数枚のウエハを一括して処理するバッチ式の処理装置においては、８インチウエハの場合、プラスチック製の搬送用容器であるカセット（キャリアともいう）内に複数枚例えば２５枚のウエハを垂直状態で収容したままの状態で、下方からカセット内のウエハにローラを接触させて回転を与え、オリフラを一方向に整列させるようにしたバッチ式の基板整列装置が提案されている。また、ウエハを一枚ずつ処理する枚葉式の処理装置においては、回転テーブル上にウエハを一枚ずつ載せて、ウエハの向きおよび中心の位置合せを行うようにした機構が提案されている。

【０００４】

【発明が解決しようとする課題】しかしながら、ウエハの直径が例えば１２インチ（３００ｍｍ）を超える大口径化に伴い、既存のバッチ式基板整列装置では、ウエハに自重によるストレスが多くかかるようになるため、適用することが困難になって来ている。また、ウエハのパーティクル汚染を抑えるために密閉型のカセットが検討されているが、この場合にはカセット内でウエハの位置合せを行うことができない。

【０００５】このような場合には、ウエハをカセット内から取り出して位置合せを行わなければならないが、例えば熱処理をバッチ式に行う熱処理装置では、ウエハを複数枚例えば５枚ずつ一括して熱処理用治具であるウエハボートに移載することから、既述のように回転テーブルにウエハを一枚ずつ載せて行う機構ではスループットが低下してしまう。

【０００６】そこで、本発明は、上述した課題を解決すべくなされたものである。本発明の目的は、複数枚の被処理基板に対して一括して中心および向きの位置合せを行うことができる基板整列方法およびその装置を提供することにある。

【０００７】

【課題を解決するための手段】上記目的を達成するために本発明の基板整列方法は、搬送アームにより水平状態で多段に支持されて水平方向から搬送された複数枚の被処理基板の周縁部を多段の支持部によりすくい上げて支持する工程と、上記支持部に多段に支持された被処理基板の周縁部に支柱を少なくとも３方向から接触させて一括して心出しを行う工程と、上記支持部を下降させて支持部と対応する多段の回転テーブル上に上記被処理基板を載置し、被処理基板を回転させてその周縁部に有する位置決め用の印を検出し、その印が一方向に揃うように整列させる工程とを備えたことを特徴とする。

【０００８】これにより、複数枚の被処理基板に対して一括して中心および向きの位置合せを行うことが可能と

なる。上記基板整列方法においては、上記回転テーブルの駆動により被処理基板を回転させ、上記印が検出部を越えるように回転を停止させた後、逆方向に低速で回転させながら上記検出部により印を検出することが検出精度の向上を図る上で好ましい。

【０００９】また、本発明の基板整列装置は、搬送アームにより水平状態で多段に支持されて水平方向から搬送された複数枚の被処理基板の周縁部をすくい上げて多段に支持する昇降可能な支持部と、上記支持部の周囲に配置されてほぼ半径方向に移動可能に設けられ、上記被処理基板の周縁部に少なくとも３方向から接触して一括して心出しを行う支柱と、上記支持部に対応してその内側に多段に配置され、支持部の下降により被処理基板を載置する回転テーブルと、被処理基板の周縁部に有する位置決め用の印を検出する検出部と、この検出部からの検出信号により上記印が一方向に揃うように回転テーブルの回転量を制御する制御部とを備えたことを特徴とする。

【００１０】これにより、簡単な構成で複数枚の被処理基板に対して一括して中心および向きの位置合せを行うことが可能となり、装置のコンパクト化およびスループットの向上が図れる。上記基板整列装置においては、上記支持部に、被処理基板をすくい上げる時にその周縁部に接して予備的な心出しを行うテーパー部と、心出しされた被処理基板の周縁部を小範囲で水平移動可能に支持する段部とを有する支持ピンが設けられていることが被処理基板にストレスを与えないように２段階で心出しを行う上で好ましい。また、上記回転テーブルがその基部側回転部を内部に収容した中空の支持フレームに設けられており、この支持フレームには内部を負圧に排気する排気手段を接続するための排気口が設けられていることがパーティクル汚染を防止する上で好ましい。

【００１１】

【実施の形態】以下に、本発明の実施の形態を添付図面に基づいて詳述する。図１は本発明の実施の形態に係る基板整列装置を含む移載ステーションの一部を示す概略斜視図、図２は同基板整列装置を示す平面図、図３は同基板整列装置を示す側面図である。

【００１２】バッチ式処理装置の一つである例えば縦型熱処理装置の筐体内には、被処理基板である半導体ウエハＷの移載を行うための移載ステーションが設けられている。この移載ステーションには、大口径例えば直径３００ｍｍの複数枚例えば１３枚のウエハＷを多段に収容したプラスチック製の搬送用容器であるカセット１と、複数枚例えば５枚のウエハＷを多段に支持して同軸上（同一中心線上）で心出し（中心の位置合せ：センタリング）およびノッチ合せ（周方向の位置合せ）を行う基板整列装置２と、これらカセット１と基板整列装置２との間あるいはこの基板整列装置２と図示しない熱処理用治具である垂直起立状態のウエハボートとの間でウエハＷの移替えを行う移載機構３とが設けられている。

【００１３】上記ウエハＷの周縁部には、結晶方向を示す位置決め用の印として、小半円形の切欠部であるノッチ４が設けられている（図２参照）。上記カセット１は、移載ステーションにおけるカセットステージに載置される。上記カセット１としては、ウエハＷのパーティクル汚染を抑えるために、前面開放部に図示しない着脱可能な蓋体を備えた密閉型であることが好ましい。カセット１の蓋体は、図示しない開閉機構により開閉されるようになっている。

【００１４】上記移載機構３は、複数枚例えば５枚のウエハＷを一括して移載できるように薄板状のフォーク５を多段に有する搬送アーム６を備えており、この搬送アーム６が水平方向に進退、水平回動および昇降可能に構成されている。また、上記搬送アーム６のフォーク５は、配列間隔（上下間隔）が可変に構成されていることが好ましい。

【００１５】上記基板配列装置２は、図２ないし図３にも示すように、上記搬送アーム６により水平方向から搬送された複数枚のウエハＷの周縁部をすくい上げて多段に支持する昇降可能な支持部７を備えている。この支持部７は、平面ほぼＵ字状に形成された水平な支持板８により構成されている。支持板８は、上下方向に適宜間隔例えば上記カセット１内のウエハ収納間隔（ウエハ収納溝ピッチ）と同じ間隔で多段例えば５段に配置され、基端部が昇降枠９に共通に取付けられることにより、片持梁状に設けられている。これら支持板８の間隔を精度よく保持するために、隣合う支持板８の基部側間にスペーサ１０を介設し、これらスペーサ１０を介して支持板８を昇降枠９に固定することが好ましい。

【００１６】上記昇降枠９は、ベースプレート１１上に立設された固定枠１２にガイド例えばリニアガイド１３を介して昇降可能に支持されている。また、固定枠１２には、上記昇降枠９を昇降操作する例えばボールネジを有する昇降駆動部１４が取付けられている。昇降枠９の昇降高さレベルの検出は、昇降駆動部１４にエンコーダ等のセンサーを設けて行うようにしてもよく、あるいは図示例のように、昇降枠９に被検出体であるドグ１５を設け、固定枠１２にそのドグ１５を検出するセンサー１６を設けて行うようにしてもよい。

【００１７】上記支持部７を構成する支持板８は、その上面にウエハＷの下面を面接触で直接支持するように構成されていてもよいが、ウエハ心出し時の摩擦抵抗の軽減やフォーク５による移載の容易化等を図るために、支持板８の上面に各ウエハＷの周縁部を支持板８の上面から浮かせた状態で支持する複数個例えば４個の支持ピン１７が周方向に適宜間隔で設けられていることが好ましい。また、この支持ピン１７は、ウエハＷをすくい上げる時にその周縁部に接して予備的な心出しを行うテーパー部１８と、心出しされたウエハＷの周縁部を小範囲で

水平移動可能に支持する段部１９とを有していることが後述する如くウエハにストレスを与えないように２段階で心出しを行う上で好ましい。

【００１８】上記支持ピン１７は、例えば所定高さの円柱部の上端にこれよりも小径の円錐部もしくは裁頭円錐部を形成することにより簡単に得られる。支持ピン１７の上端とその直上に位置する支持板８との間には、ウエハＷを水平方向から搬入搬出するための所定の隙間が形成されている必要がある。上記支持ピン１７の材料としては、例えば石英であってもよいが、摩擦抵抗が小さく、またウエハに対するパーティクル汚染も少ない樹脂例えばＰＥＥＫ樹脂が好適である。

【００１９】上記支持部７の周囲には、各段のウエハＷの周縁部に少なくとも３方向から接触してウエハＷの心出しを一括して行う支柱２０が配置され、これら支柱２０がウエハＷのほぼ半径方向に移動可能に設けられている。図示例では、支柱２０は、ウエハＷの周囲に位置するようにその周方向にほぼ等間隔で３本配置されており、レイアウト上そのうちの１本が支持板８の内側に配置されている。また、支持板８の周縁部には、他の２本の支柱２０との干渉を避けるための切欠部２１が設けられていることが好ましい。支柱２０の材料としては、例えば石英であってもよいが、アルミナが好適である。また、支柱２０の形状としては、円柱状が好ましい。

【００２０】上記支柱２０をウエハＷのほぼ半径方向に移動操作する駆動手段として、上記ベースプレート１１上には、各支柱２０の下端部を支持してウエハＷのほぼ半径方向に進退移動させるエアシリンダ２２が配設されている。図示例のエアシリンダ２２は、上部にリニアガイド２３を介して水平方向に進退移動する作動体２４を備えており、この作動体２４に上記支柱２０が立設されている。上記支柱２０の移動ストロークを規制するために、上記ベースプレート１１上には、図７にも示すように、エアシリンダ２２の一側方に位置させてこれと平行なストッパー軸２５がストッパーベース２６を介して設けられている。

【００２１】上記ストッパー軸２５には、上記エアシリンダ２２の作動体２４に固定されたアーム２７が摺動可能に係合されており、これにより支柱２０の移動ストロークエンド（前進エンドと後退エンド）が規制されるように構成されている。また、上記ストッパー軸２５の基部側には、ストッパーベース２６に螺合するネジ部２８が形成されており、ストッパー軸２５を回転することにより、支柱２０の移動ストロークエンドの位置を調整できるようになっている。支柱２０がウエハＷの周縁部を必要以上に押圧してストレスを与えることがないようにするために、その前進エンドの位置を上記ストッパー軸２５の回転により調整する。

【００２２】上記支持部７の内側には、支持部７の下降によりウエハＷを載置する円板状の回転テーブル２９が

支持部７の支持板８と対応して多段例えば５段に配置されている。各回転テーブル２９は、水平な支持フレーム３０の先端側上部に設けられており、各支持フレーム３０の基部側が上記固定枠１２に共通に固定されている。上記回転テーブル２９および支持フレーム３０は、上記支持板８の昇降移動に干渉しない大きさに形成されている。

【００２３】上記回転テーブル２９の上面には、ウエハＷを直接支持してもよいが、ごみの付着防止等の観点よりウエハＷを回転テーブル２９の上面から浮して支持するための複数例えば３個の突状支持材３１が設けられていることが好ましい。この突状支持材３１の材料としては、緩衝性および摩擦抵抗を有するもの、その中でもウエハに対するパーティクル汚染の少ない例えばフッ素系ゴム、具体的にはカルレッツ（商品名）が好ましい。

【００２４】上記支持フレーム３０は、図４にも示すように、回転テーブル２９の基部側回転部３２を収容するために内部が中空となった箱状に形成されていることが好ましい。この場合、支持フレーム３０は、上部が開放された箱状に形成されており、その上部にフレームカバー３３がネジ止め等により着脱可能に取付けられていることがメンテナンス上好適である。上記支持フレーム３０内の先端側には、支軸３４が立設され、この支軸３４に軸受例えばクロスベアリング３５を介して従動プーリ３６が上記フレームカバー３３を貫通する状態で回転可能に取付けられ、この従動プーリ３６の上端部に回転テーブル２９がネジ止め等により着脱可能に取付けられている。上記従動プーリ３６等が回転テーブル２９の基部側回転部３２を構成している。

【００２５】上記支持フレーム３０内の基端側には、電動モータ好ましくはパルスモータ３７で駆動される駆動プーリ３８が配置され、この駆動プーリ３８と上記従動プーリ３６にはベルト好ましくはタイミングベルト３９が巻き掛けられている。上記モータ３８は、図５にも示すように、モータベース４０に取付けられており、このモータベース４０が上記支持フレーム３０の基端側下面にネジ４１で取付けられている。

【００２６】上記モータベース４０には、ネジ４１での取付けに際して位置調整が可能なように長穴４２が設けられていると共に、上記タイミングベルト３９に所望のテンションを与えるべくモータベース４０を引っ張るためのフック４３が一体的に設けられている。このフック４３にプルゲージを引っ掛けて引っ張ることにより、タイミングベルト３９を適正な張力で張ることができる。なお、隣合うモータ３７同士の干渉を避けるために、モータ３７は左右に交互に配置されていることが好ましい。

【００２７】また、上記支持フレーム３０の基端側には、図６にも示すように、内部を負圧に排気する図示しない排気手段例えば排気系に通じる吸引チューブを接続

するための排気口４４が設けられていることがパーティクル汚染を防止する上で好ましい。これにより、回転テーブル２９の基部側回転部３２やタイミングベルト３９等から発生するごみが支持フレーム３０外に飛散することを防止でき、ウエハWのパーティクル汚染を防止できる。

【００２８】一方、上記支持部７の側方には、ウエハWの周縁部に有するノッチ４を検出する検出部４５が設けられ、この検出部４５からの検出信号に基いて上記ノッチ４が一方向に揃うように回転テーブル２９の回転量を制御部４６により制御するように構成されている。上記検出部４５は、ベースプレート１１上に立設されたセンサータワー４７に各回転テーブル２９上のウエハWと対応して設けられている。

【００２９】上記検出部４５は、図８にも示すように、各ウエハWの周縁部を挟んで対向する投光部４８と受光部４９を有する光センサーからなり、投光部４８から受光部４９に向う例えば赤外光線からなる光軸がウエハWの周縁部で遮断された状態から、ノッチ４を通って通過する状態になることによりノッチ４の位置を検出できるようになっている。誤検出を防止するために、隣合う光センサー間には遮光板５０が配置されていることが好ましい。また、上記支持板８の周縁部には、検出部４５を有するセンサータワー４７との干渉を避けるために切欠部５１が設けられていることが好ましい。

【００３０】上記ウエハWのノッチ４を一方向に整列させる基板整列方法においては、上記回転テーブル２９の駆動によりウエハWを一方向に回転させ、上記ノッチ４が検出部４５を越える（オーバーランする）ようにして回転を停止させた後、逆方向に低速で回転させながら上記検出部４５によりノッチ４を検出するように構成されていることが検出精度の向上を図る上で好ましい。また、上記検出部４５によりノッチ４の位置を検出したら、その位置から所望の回転角度だけウエハWを回転させるようにすることにより、ノッチ４を所望の方向に整列させることができる。

【００３１】以上の構成からなる基板整列装置２は、設置台５２上に設置されるが、その場合、位置決めの容易化を図るためにキネマティック・カップリング５３を採用することが好ましい。このキネマティック・カップリング５３は、図３ないし図９に示すように、基板整列装置２のベースプレート１１の底部に配設された断面逆Ｖ字状の溝５４を有するブロック５５と、このブロック５５の溝５４に係合する球面状の先端部を有する軸体５６とから構成されている。

【００３２】上記ブロック５５は、ベースプレート１１の下面に所定の間隔で放射状に３個取付けられる。上記軸体５６は、設置台５２に上記ブロック５５と対応させて３本立設される。軸体５６は、設置台５２に螺合されていて高さ調整が可能になっている。これら軸体５６上にブロック５５の溝５４が係合するように基板整列装置２を載置することにより、基板整列装置２を所定の位置に容易に位置決めすることができる。位置決め後、図示しない固定ボルトにより基板整列装置２のベースプレート１１を設置台５２に固定すればよい。このように位置決めが容易にできるため、狭隘な空間に基板整列装置２を設置する場合にも、設置が正確且つ容易にでき、メンテナンスも容易である。

【００３３】上記３個のブロック５５のうち、１個のブロック５５は基板整列装置２に対する搬送アーム６によるウエハWの搬送方向Ｘに一致させておくことが好ましい。これにより、他の２個のブロック５５に対応する軸体５６による左右の高さ調整を行うだけで、搬送されるウエハWに対する平行調整を容易に行うことが可能となる。

【００３４】次に、上記構成からなる基板整列装置２の作用および基板整列方法について述べる。先ず、移載機構３の搬送アーム６のフォーク５をカセット１内に進入させて複数枚例えば５枚のウエハWを多段状態で一括してすくい上げ、カセット１内から搬出する。次に、基板整列装置２の方向に上記フォーク５の向きを変えて前進させることにより、ウエハWを基板整列装置２内に水平方向から搬入する。この時、基板整列装置２における支持部７の支持板８は、昇降ストロークのほぼ中間位置に設定されており、ウエハWおよびフォーク５は、支持板８上の支持ピン１７や回転テーブル２９と接触することなく最上段の支持板８上方および隣合う支持板８間に水平に進入する。

【００３５】上記搬送アームによりウエハWが基板整列装置２内に搬送されると、昇降駆動部１４が起動し、昇降枠９を介して支持板８が上昇エンドまで上昇移動する。これら支持板８の上昇移動により、ウエハWがフォーク５上からすくい上げられる。この時、支持板８上に設けられている支持ピン１７がテーパー部１８と段部１９を有する形状に形成されているため、ウエハWの周縁部が支持ピン１７のテーパー部１８により内方へ案内され、概略的で予備的な心出しが行われながら、最終的に段部１９に支持される。上記すくい上げ終了後、フォーク５が基板整列装置２から後退する。

【００３６】次に、後退位置に待機している心出し用の３本の支柱２０がエアシリンダ２２の駆動によりほぼ半径方向内方へ前進し、これら支柱２０が各段のウエハWの周縁部に同時に接触して押圧することにより、複数枚のウエハWの心出しが一括して行われる。この時、ウエハWの周縁部が支持ピン１７の段部１９上に小範囲で水平移動可能に支持されていることから、心出しが円滑に容易に行われる。上記支柱２０の前進エンドがストッパー軸２５により規制されることにより、ウエハWには必要以上の押圧力が作用することがなく、ウエハWにストレスを与える恐れはない。

【００３７】また、第１段階として、支持ピン１７のテーパー部１８により各段のウエハWの概略的で予備的な心出しを個別に行った後、第２段階として、共通の支柱２０により一括して全段のウエハWの最終的な心出し（本心出し）を行うというようにウエハWの心出しを２段階で行うようにしたので、ウエハWにストレスを与えることなく円滑に心出しを行うことが可能となる。この心出しにより、ウエハWの中心が回転テーブル２９の回転中心に一致される。上記心出しの終了後、支柱２０は後退エンドまで後退してウエハの周縁部から離れる。

【００３８】次に、支持部７の支持板８が下降エンドまで下降移動し、各段のウエハWが支持ピン１７上から回転テーブル２９上に受け渡される。こうしてウエハWが回転テーブル２９上に載置されると、回転テーブル２９がモータ３７の駆動により一方向例えば時計方向に回転し、ウエハWを回転させる。このウエハWの回転により、その周縁部のノッチ４が光センサーからなる検出部４５に至ると、この検出部４５によりノッチ４の位置が検出され、この検出信号に基いて制御部４６によりノッチ４が一方向に揃うように回転テーブル２９の回転量が制御される。

【００３９】この場合、上記回転テーブル２９の駆動によりウエハWを一方向（時計方向）に回転させ、上記ノッチ４が検出部４５を越える（オーバーランする）ようにして回転を停止させた後、逆方向（反時計方向）に低速で回転させながら上記検出部４５によりノッチ４を検出するように制御することが好ましい。これにより、ノッチ４の位置を正確に検出することが可能となる。また、上記検出部４５によりノッチ４の位置を検出したら、その位置から所定の回転角度だけウエハWを同方向（反時計方向）に回転させるようにすることにより、ノッチ４を所定の方向に向けて整列させることができる。

【００４０】こうしてウエハWの心出しおよびノッチ合せが終了したなら、支持板８が昇降ストロークのほぼ中間位置まで上昇移動することにより、回転テーブル２９上からウエハWをすくい上げる。次いで、ウエハWと回転テーブル２９との間に搬送アーム６のフォーク５が進入し、ウエハWをすくい上げて基板整列装置２から搬出し、図示しないウエハボートに移載する。

【００４１】このように上記基板整列装置２ないし基板整列方法によれば、複数枚のウエハWを多段に支持して同軸上で心出しおよびノッチ合せを行うことが可能となり、スループットの向上が図れ、例えば密閉型のカセットを用いた場合のスループット対策に有効である。また、多段構造で、構成が簡単であるため、コンパクト化が図れ、占有スペースも狭くてよい。

【００４２】以上、本発明の実施の形態を図面により詳述してきたが、本発明は上記実施の形態に限定されるものではなく、本発明の要旨を逸脱しない範囲での種々の設計変更等が可能である。例えば、ウエハWの周縁部に設けられる印としては、必ずしもノッチ、あるいはオリフラである必要はなく、例えばマークやバーコード等であってもよい。また、回転テーブル２９の駆動手段としては、必ずしもベルト駆動である必要はなく、例えば薄型のモータを回転テーブルに直結するようにしてもよい。

【００４３】また、基板整列装置２は、複数台並設して使用するようにしてもよい。例えば、図１０に示すように、カセットステージにカセット１を左右に２個並べて設置するようにし、その下方に基板整列装置２を左右に２台設置するようにしてもよい。これによれば、一方の基板整列装置でウエハの心出しおよびノッチ合せを行っている間に他方の基板整列装置におけるウエハの移載作業を行うことができ、スループットの更なる向上が図れる。

【００４４】

【発明の効果】以上要するに本発明によれば、次のような効果を奏することができる。

【００４５】（１）本発明の基板整列方法によれば、搬送アームにより水平状態で多段に支持されて水平方向から搬送された複数枚の被処理基板の周縁部を多段の支持部によりすくい上げて支持し、この支持状態で被処理基板の周縁部に支柱を少なくとも３方向から接触させて心出しを一括して行った後、上記支持部を下降させて支持部と対応する多段の回転テーブル上に上記被処理基板を載置し、被処理基板の周縁部に有する位置決め用の印が一方向に揃うように整列させるため、複数枚の被処理基板に対してストレスを与えることなく一括して中心および向きの位置合せを限られたスペース内で容易に行うことが可能となり、スループットの向上が図れる。

【００４６】（２）本発明の基板整列装置によれば、搬送アームにより水平状態で多段に支持されて水平方向から搬送された複数枚の被処理基板の周縁部をすくい上げて多段に支持する昇降可能な支持部の周囲に被処理基板の周縁部に少なくとも３方向から接触して心出しを一括して行う支柱を配設し、上記支持部の内側に支持部の下降により被処理基板を載置する回転テーブルを多段に配設し、被処理基板の周縁部に有する位置決め用の印を検出部により検出して、制御部により上記印が一方向に揃うように回転テーブルの回転量を制御するようにしたので、簡単な構成で複数枚の被処理基板に対して一括して中心および向きの位置合せを行うことが可能となり、装置のコンパクト化およびスループットの向上が図れる。

【図面の簡単な説明】

【図１】本発明の実施の形態に係る基板整列装置を含む移載ステーションの一部を示す概略斜視図である。

【図２】同基板整列装置を示す平面図である。

【図３】同基板整列装置を示す側面図である。

【図４】回転テーブルの支持フレームを示す縦断面図である。

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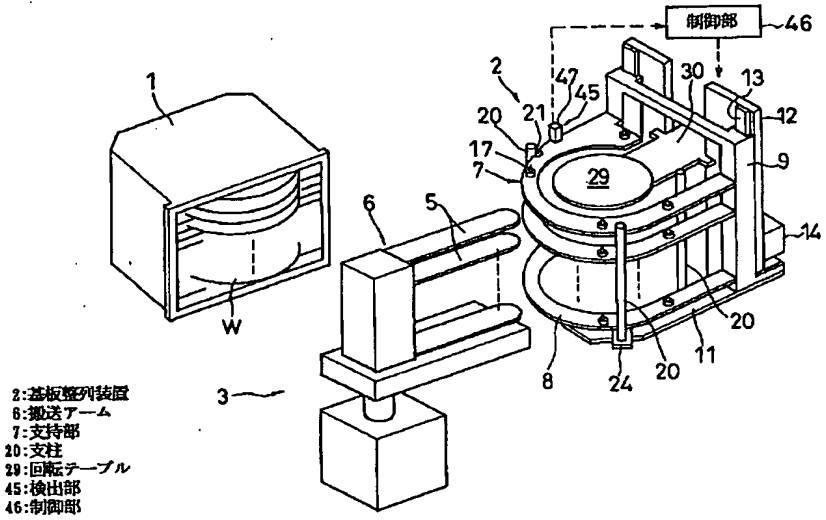
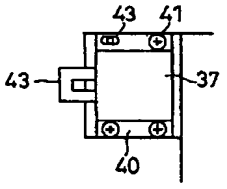
【図５】モータ部分を下方から見た状態を示す底面図である。
【図６】支持フレームの基部側の内部構造を示す平面断面図である。
【図７】支柱の駆動機構を示す一部断面平面図である。
【図８】検出部を示す側面図である。
【図９】キネマティック・カップリングの配置構成を概略的に示す説明図である。
【図１０】処理装置において基板整列装置を２連に配置した場合の配置構成を概略的に示す説明図である。
【符号の説明】
Ｗ　半導体ウエハ（被処理基板）
２　基板整列装置
４　ノッチ（印）
６　搬送アーム
７　支持部
１７　支持ピン
１８　テーパー部
１９　段部
２０　支柱
２９　回転テーブル
３０　支持フレーム
４４　排気口
４５　検出部
４６　制御部

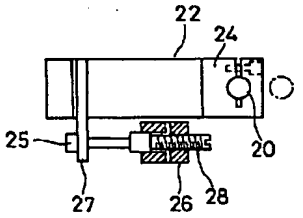
【図１】



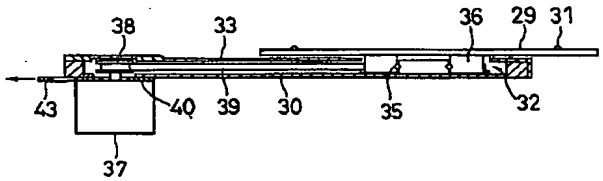
【図５】



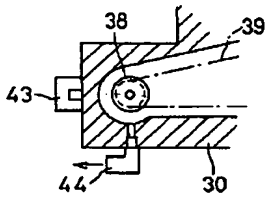
【図７】



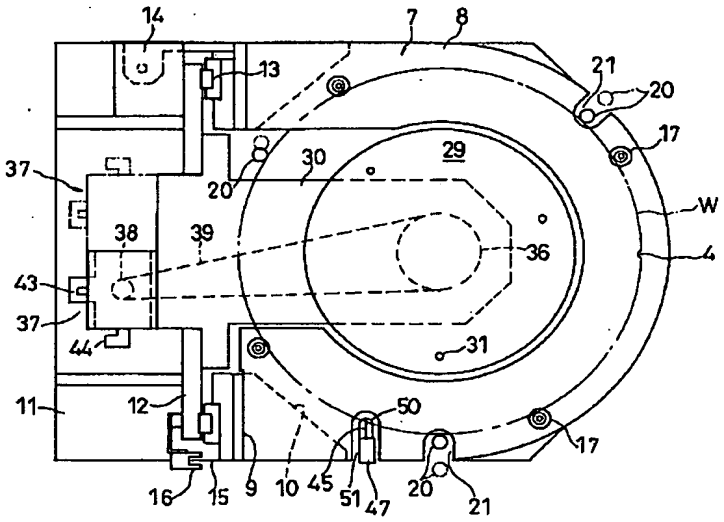
【図４】



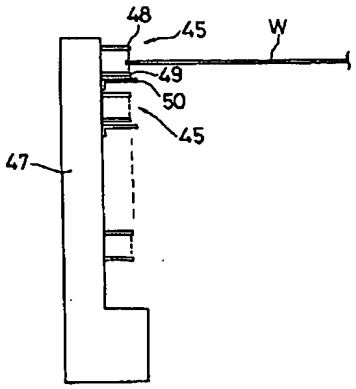
【図６】



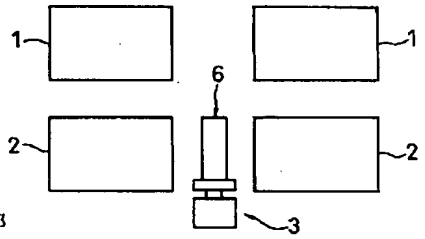
【図２】



【図８】

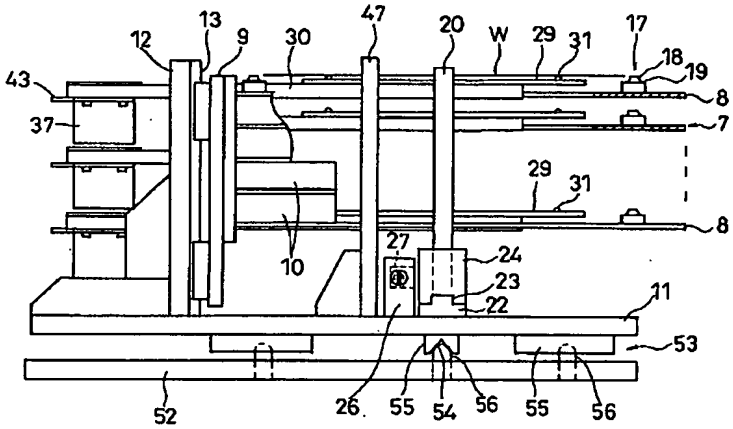


【図１０】



17:支持ピン
18:テーパー部
19:段部

【図３】



【図９】